

What is claimed is:

1. A method for measuring an evolution rate of a gas from a sample, the method comprising the steps of:

5 equilibrating a sample with a solution comprising an alkaline solution and a pH indicator;

permitting the alkaline solution to absorb formed carbon dioxide in an enclosed space;

10 following the equilibrating step, determining from a change in the pH indicator a time increment at which an increment of the alkaline solution is substantially consumed by the carbon dioxide;

15 calculating from the time increment a carbon dioxide evolution rate.

2. The method recited in Claim 1, wherein the equilibrating step comprises shaking the sample and the solution to enhance carbon dioxide absorption.

3. The method recited in Claim 1, wherein the shaking step comprises shaking at a fixed rate.

20 4. The method recited in Claim 1, wherein the alkaline solution comprises sodium hydroxide and barium chloride.

5. The method recited in Claim 1, wherein the indicator comprises phenolphthalein.

6. The method recited in Claim 5, wherein the indicator further comprises an
5 ethanol solution.

7. The method recited in Claim 1, further comprising the step of performing a pre-equilibration comprising the steps, prior to the equilibrating step, of:

equilibrating the sample with a first amount of the solution comprising an
10 alkaline solution and a pH indicator, the first amount sufficient to absorb the carbon dioxide
formed during a predetermined amount of time;

15 permitting the alkaline solution to absorb the formed carbon dioxide in the
enclosed space for the predetermined amount of time; and

withdrawing the alkaline solution to leave a predetermined portion in the
15 reaction chamber following the equilibrating step.

8. The method recited in Claim 7, wherein the portion comprises substantially
none of the solution.

20 9. The method recited in Claim 7, wherein the equilibrating step comprises
equilibrating a sample with a predetermined quantity of the alkaline solution and the portion
comprises the predetermined quantity.

10. The method recited in Claim 1, wherein the equilibrating step comprises injecting a predetermined quantity of the alkaline solution into the reaction chamber.

11. The method recited in Claim 10, further comprising the steps of:

5 repeating the equilibrating, permitting, and determining step a predetermined number of times; and

averaging the time increments from the repeated equilibrating, permitting, and determining steps; and wherein

10 the calculating step comprises calculating from the averaged time increment a carbon dioxide evolution rate.

15 12. The method recited in Claim 1, wherein the change in the pH indicator comprises a visualizable color change.

13. The method recited in Claim 1, wherein the calculating step comprises using the following equation:

$$\text{carbon dioxide evolution rate} = (0.1 \times 10^3 \times M/2)/60t,$$

20 wherein M is the concentration of the solution and t is the time increment.

25 14. A device for measuring an evolution rate of a gas from a sample, the device comprising:

a sample vial having an opening into an interior space for containing a sample therein; and

a reaction chamber having an opening adapted for mating with the sample vial opening and a solution-receiving opening for receiving a solution comprising an alkaline solution and a pH indicator, the reaction chamber dimensioned for equilibrating the sample with a predetermined amount of the solution to attain a CO₂ absorption/evolution equilibrium between the alkaline solution and the sample.

15. The device recited in Claim 14, wherein the sample vial has a threaded coupling adjacent the opening and the reaction chamber has a septum liner leading to the sample vial, the septum liner matable with the threaded coupling.

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15. The device recited in Claim 14, wherein the reaction chamber comprises a substantially transparent spherical member and the solution-receiving opening is adapted for receiving a syringe tip thereinto.

17. A system for measuring an evolution rate of a gas from a sample, the system comprising:

a respirometer device comprising:

20 a sample vial having an opening into an interior space for containing a sample therein; and

a reaction chamber having a mixing opening adapted for mating with the sample vial opening and a solution-receiving opening for receiving a solution comprising an alkaline solution and a pH indicator, the reaction chamber dimensioned for equilibrating the sample with a predetermined amount of the alkaline solution; and

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means for determining from a change in the pH indicator a time increment at which an increment of the alkaline solution is substantially consumed by the formed CO_2 .

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18. The system recited in Claim 17, further comprising means for shaking the sample and the solution to enhance carbon dioxide absorption.

19. The system recited in Claim 18, wherein the shaking means comprises means for shaking at a fixed rate.

20. The system recited in Claim 19, wherein the shaking means comprises an orbital shaker.

21. The system recited in Claim 17, further comprising a syringe for injecting solution into the reaction chamber.

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22. The system recited in Claim 17, wherein the alkaline solution comprises sodium hydroxide and barium chloride.

23. The system recited in Claim 17, wherein the indicator comprises phenolphthalein.

24. The system recited in Claim 23, wherein the indicator further comprises an
5 ethanol solution.

25. The system recited in Claim 17, further comprising means for withdrawing at least some of the solution following a pre-equilibration period to leave a predetermined portion in the reaction chamber.